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ABSTRACT

Farming has undergone substantial changes in both economic and social structure in the past 40 years; these changes have affected the larger society with population changes in rural, nonmetropolitan areas. Seeking to explore the relationships between changes in farming and changes in place population for Michigan from 1930 to 1970, six variables were utilized as indicators of the changing structure of farming: farm land in crops, value of land and buildings per acre, average farm size, gross sales per farm, number of farm workers, and farm population. The commonly used dependent variable of change in the total population of nonmetropolitan counties was replaced with two variables measuring the population change of smaller places in all counties; longitudinally measured independent variables were also used. Change in farm size was found to be strongly associated with the percent of places losing population; the greater the increase in farm size form 1930 to 1970, the greater the proportion of declining places. A relatively strong association existed between changes in farm size and farm population. As farms expanded and became less numerous, both farm workers and farm families were displaced from farms and the farm population. Conceptual, operational, and statistical modifications of the study suggested that farm changes have played a more important role in population changes in smaller places than that indicated in earlier analyses using different measures and units. (Author/DS)

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Farming and Place Population Change in Michigan, 1930-1970: An Exploratory Analysis[1]

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Introduction

The substantive question to be addressed in this paper is: What have been the relationships between changes in the social and economic structure of farming and the changes in population of smaller places for Michigan in the period 1930 to 1970? In a deductive approach we will review the relevant literature on farm structure and place population changes to generate variables and hypotheses for the analysis, specify the methodological procedures for analysis, then report the results of the analysis itself. However, in carrying out the review we have found some empirical attempts to assess the relative importance of farm changes on population change to be limited by their conceptualization, by their operationalization of variables, and by the analytical technique employed. Hence, we proposed certain changes which we thought necessary to improve the explanation and understanding of these changes and their interrelationships. In this exploratory analysis, this testing of a suitable methodological approach ranks equal in importance to the substantive task.

Review of the Literature

Many of the changes affecting the U. S. farm population--and the rural population generally--stem from farm commercialization, specialization, technological change, and the most dramatic of these have occurred since 1935 (see Table 1).[3] Overproduction, fluctuating prices, cost-price squeezes and indebtedness have been constant companions of the historical development of farming (Hacker, 1970, Ch. 11; Frundt, 1975: 14-29; Goss et al., 1978: 25-27). The general response by farmers, backed by government assistance and corporate interests, has been to expand the size of their operations (Padfield, 1971; Rodefeld, 1978:162-164). Commercialization and specialization by type of

production are closely related. They describe the tendency for farms to concentrate on specific commodities for market. The present-day commercial, specialized farm produces very little for home consumption and may have only one or, at most, a few enterprises (White and Irwin, 1972; Goss, 1976: 101-104). One general indicator of enterprise changes is the amount and proportion of farm land in crops.

(Table 1 about here)

Technological development has facilitated the commercialization, specialization and expansion in farm production. Mechanization by its very nature, substitutes inanimate power for human power, and hence more land can be cultivated from the same labor input. The other component of technology--biological advance--increases production per unit of land through the use of herbicides, insecticides, hybrid seeds, fertilizers, etc. (Donaldson and McInerney, 1973; Rodefeld, 1974: 110-122; Goss, 1976: 79-81). Both components of technology have contributed to the increased capital requirement of farms (Brake, 1972; Goss et al., 1978: 24-25), and where this development has been intensive in nature, the value of land and buildings per acre has risen (see Table 1). There has also been expansion of an extensive nature, due mainly to mechanization. With acres of total farm land remaining approximately constant since 1935, this capital for labor substitution has resulted in an increase in the average acreage of farms (see Table 1) and a decrease in the total number of farms (Ball and Heady, 1972; Rodefeld, 1978: 171-173). When one combines these two elements of farm expansion--increased production per acre, and increased number of acres--there has been a sizeable increase in total production and value of output (gross sales) per farm (Goss, 1976: 99-101; see Table 1).

Labor displacement by mechanization and the decline in farm numbers have contributed to a decrease in the number of farm workers (see Table 1). Both hired workers, owner-operators and their families have been displaced (Tolley and Farmer, 1967; Goss, 1976: 90-92; Rodefeld, 1978: 169-171). Without employment in farming, these people have usually migrated to urban areas where employment chances and median family incomes have generally been better (McDonald, 1955-56; Goss, 1976: 142-144). Consequently, the farm population has decreased markedly since 1935 (see Table 1).

Thus farming has undergone substantial changes in both economic and social structure in the past 40 years. From this review of the literature we have selected six independent variables for our analysis: (1) acres of crop land; (2) value of farm land and buildings per acre; (3) average farm size in acres; (4) gross sales per farm; (5) number of workers employed in farming; and (6) number of farm people.

Another questions is to what extent have these farm changes affected the larger society?[4] They have occurred in the context of a rural society characterized by a dispersed settlement pattern with small trade centers to serve the needs of farms, farm people, neighborhoods and communities (Ensminger, 1949; Ensminger and Longmore, 1949; Etua, 1977: 23-30). The typical pattern in the Midwest has been a population center (hamlet, village, town)[5] servicing the economic and technical needs of the farm hinterland, which was also the focal point of community (Galpin, 1915; Kolb, 1959).

Nationwide studies for the 1930 to 1970 period have shown that more than half the places with less than 250 persons declined in size, as did 30 percent of places 250 to 2500 in size (Goss 1976: 132-133, 162). Population decreases were greater for the 1950 to 1970 period. The ability of smaller places to retain population was enhanced by proximity to larger places, particularly metropolitan centers (Hassinger, 1957a; Butler and Fuguitt, 1970; Etua, 1977: 72-79).

The population changes in these places were directly related to the number of economic services and social functions they were able to provide (Hassinger, 1957b; Fuguitt and Deely, 1966; Brunn, 1968; Etua, 1977: 60-72). It was the changing demand and supply of services and functions that best explained the link between farm and place. On the one hand, the decline in farm population reduced aggregate demand and hence reduced the need for nonfarm persons responsible for such services and functions. Smaller places entered a declining spiral of decreased variety of services and functions and decreased patronage by local people (Bollinger, 1972; Rodefeld, 1974: 214-229). Alternatively, larger places were able to consolidate these lost services and functions, and add new ones. Their patronage was increased and hinterlands expanded as consumer demands became more specialized and their means of transportation improved. Thus, as the minimum viable size for farm dependent places increased, (Raup 1961) there was a growing dualism between larger, expanding places and smaller, declining ones (Wilkinson, 1974; Goss, 1976: 137-141).

Places, particularly smaller places, are at the interface between the farm and nonfarm populations. Their decline or growth is part of the population redistribution process occurring within the nonfarm sector. It is for this reason that we have chosen to focus on changes in the population of smaller places--more specifically, county level indicators of these changes. Three operationalizations of the dependent variable will be used in this analysis: (1) percent change in the total population of nonmetropolitan counties (a replication of the measure used by many recent studies of population change); (2) percent change in aggregate population of all places of 75-2500 persons; and (3) percent of all places in each county declining in population. The latter two operationalizations focus specifically on the changing status of smaller places.

Of course, there are other factors affecting population change in places--industrialization, urbanization, transportation, etc. (Field and Dimit, 1970; Etua, 1977: 31-47). We will not attempt to include them in the analysis alongside the farm independent variables.[6] However, we will employ two alternative factors--proximity to large places and regional location--to gain some insight into the extent of these influences over and above the changes in farming. The proximity factor is included because it has proved to be an important variable in past studies of place population change. Regional location (as operationlized in this study) is a surrogate for industrialization, urbanization and other macro-processes that are manifest in spatial distribution.

Now, let us examine several recent studies that have reaffirmed the historical relationship between changes in the economic and social structure of farming and population change in rural or nonmetropolitan areas.

From a human ecological perspective, Frisbie and Poston (1975, 1976) have found that components of sustenance organization accounted for a significant proportion of total population change in nonmetropolitan U.S. counties. Agricultural activities were particularly important predictors in this ecological complex. In general, nonmetropolitan counties that were more dependent on agriculture as a sustenance activity, were more likely to lose population for the period 1960 to 1970. This phenomenon, according to Frisbie and Poston (1975: 775), can be accounted for by the fact that mechanization of the extractive industries decreased the demand for labor, consequently people migrated out of these areas to find jobs.

In his demographic analyses Beale (1975, 1976) found that nonmetropolitan U.S. counties with more than 30 percent of employed persons in agriculture,

declined in population by 11 percent in the 1960-70 decade and have continued to experience slight net outmigration during the 1970's--the period of metropolitan-to-nonmetropolitan net migration. In fact, the greater the percent of employed persons in agriculture for the county, the greater the likelihood of population decline and the greater the annual rate of net outmigration (Beale and Fuguitt, 1976: 15, Table 6; Beale, 1977: 6, Tables 2 and 3).

It should be noted that counties most dependent on agriculture are more likely to be found in the Great Plains/Midwestern regions, and indeed this is where the relationship with population decline was the strongest (Beale, 1977: Table 2). In contrast, Debertin and Bradford (1976) found a weak but negative relationship between agricultural base of counties (measured as total value of land and buildings) and percent change in populations of incorporated Indiana places, 2,500 to 20,000 in population, for the period 1960 to 1970. Further, in a study of smaller central places in Pennsylvania (incorporated places of 1000 or more plus minor civil divisions in the immediate hinterland), Forscht and Jansma (1975) found that 73 percent of those central places most dependent on agriculture grew in population for the 1960-70 decade. For all places the relationship between percent employed in agriculture and rate of population growth was weak but positive.

The Problem

In one sense, it is surprising that agriculture still outweighs other economic activities in the determination of nonmetropolitan population change as recently as 1960-70. The farm work force and farm population have now declined to a point were a high absolute number of outmigrants cannot continue. The farm population is now less than four percent of total population whereas nonmetropolitan population is about 30 percent of the total.

How could agricultural activities still have an important influence on population change in nonmetropolitan counties or smaller places? On the other hand, limitations of past studies, including those reviewed here, may have inhibited our understanding of the role of farming in population change. Specifically, these studies are constrained by: (1) inadequate conceptualization of structural changes in farming; (2) sole use of nonmetropolitan county data; and (3) use of static independent variables in decade-by-decade research.

The studies that were reviewed above showed two extremes in approaching changes in farming--use of a single variable or factor analysis of multiple measures. Assuming percent of employed persons in farming to be a valid indicator of dependency on farming, then the more agricultural the county, the greater the magnitude of population decline (Beale, 1975, 1976, 1977). But, a single measure of dependency on farming gives little insight into the farm change process by which this outmigration has occurred. Frisbie and Poston (1976: 368) on the other hand, argued that the complexity of agricultural enterprise prevents "the conventional measurement strategy of relying on a single indicator of the underlying concept." Their approach was to take 16 different measures of farm activity and derive four factors--general agriculture, commercial agriculture, mechanized agriculture and land intensive agriculture. However, using factor analysis to establish statistically significant relationships with population change in nonmetropolitan counties is not always sufficient. Ideally, these relationships should be interpreted within the context of social and economic change in agriculture. Mechanical interpretations of factor matrices tend to inhibit further understanding. In the preceding studies little attention was given to the conceptualization of change processes in the social and economic aspects of U.S. farming.

There has also been a tendency in studies of 'rural' population change and its causes, to focus on nonmetropolitan counties (Frisbie and Poston, 1975, 1976; Beale, 1975, 1976, 1977). The Standard Metropolitan Statistical Area (SMSA) consists of those counties with a city of 50,000 or more and some contiguous counties; nonmetropolitan counties are the residual. This dichotomy is arbitrary, with little relevance to social and economic organization. For example, 22 percent of U. S. farm people were located in SMSA's in 1970. In Michigan, SMSA's contained 37 percent of the farm people, 42 percent of all rural people, and 25 percent of places with less than 1,000 persons. Frisbie and Poston (1975: 773, 882, 1976: 355) were concerned with the lack of understanding of changes in nonmetropolitan counties. This may be difficult, however, if the variation in subunit population change within these counties is greater than variation between metropolitan and nonmetropolitan counties.

The nonmetropolitan/metropolitan distinction occurs at the county level. Counties are political units that vary in geographic and social configuration across states and regions. County level research is convenient because there is a manageable number of cases (about 3,100 for the U.S.) and easy access to reliable, comprehensive data from the Censuses of Population and Agriculture. However, it appears that local residents view the county as an extra-local phenomenon (Luloff and Wilkinson, 1978). Nonetheless, this unit is often taken as a valid surrogate for another entity; the rural community (Beale, 1976: 957; 1977:1).

Alternatively, there has been a long tradition of studies dealing with place (population cluster) as the unit of analysis (e.g. Fuguitt, 1971; see Goss, 1976: 131-137, 162-163). The place, at a minimum, has a local spatial identity but this still does not make it coterminous with community. The

rural-urban dichotomy is primarily based on place; rural people are those living in places of less than 2,500 persons or in open country. Although this distinction is also an arbitrary one, at least gradation of places by population size gives some indication of the range of economic and social functions found in a place (Etua, 1977: 18-23).

Place research has also had its limitations. Minimum and maximum population sizes in studies of places have varied widely (Goss, 1976: 162-163; Etua, 1977: 90-91). Most studies have been constrained by the source from which the enumeration was taken. The Census of Population includes all places of 1,000 persons or more, regardless of legal status, but only those smaller places which are incorporated. Generalizing from this data set to the universe of smaller places is valid only if incorporated places of less than 1,000 are representative of all places in this category. Michigan data indicate this is not the case. Incorporated places (less than 1,000 in size were disproportionately larger and more likely to have been growing in population (Melcher, 1977). In short, change in total population of non-metropolitan counties or of Census enumerated places may not be reliable indicators of change in smaller places or local communities.

All studies reviewed thus far analyzed the relationships between static independent variables (characteristics for a given year) and dynamic dependent variables (change score between two points). Although such relationships are generally reliable indicators of the process involved, there are inferential dangers. It is most commonly assumed that the higher the static independent variable score, the greater has been the amount of change in that score. However, the scores may approach some 'ceiling', after which the amount of change actually decreases. In this case, the static and dynamic measures would be inversely correlated and their relationships to other variables will be in opposite directions.

Studies investigating the relationships between agricultural and population changes for the most part have been limited to 10 year periods, in particular 1960 to 1970. However, the well documented changes in farming--increased farm size, decreased farm workers and farm people--have occurred over a much longer time period, in particular 1935 to the present. Farm changes may not have affected rural or nonmetropolitan population immediately, and it is possible that time lags extended beyond the scope of decade-by-decade analyses.

This study of Michigan farming and place population change will differ from preceding ones in the following ways. First, the independent variables will be selected from concepts that are at the core of social and economic change in farming. Second, population data came from an enumeration of all incorporated and unincorporated places having 75 persons or more between 1930 to 1970. Included were places in both metropolitan and nonmetropolitan counties. Third, both independent and dependent variables will be measured longitudinally for the period 1930 to 1970.

Methodology

The data for this analysis came from the Michigan Population Center and Community Study project which was directed by Rodefeld from 1974 to 1976 (see Rodefeld, 1976). The project was based on the assumptions that there were certain causal forces, such as farm changes, transportation changes, etc. bringing about changes in the population size and economic base of Michigan and other U. S. population centers, and these latter changes in turn had significance for other community characteristics. Another assumption was that smaller places (less than 1,000 persons) were at the interface between these changes, regardless of their political status. The project data was

compiled in two parts: (1) population figures by decade, 1930 to 1970, for all Michigan places of 75 persons or more; and (2) selected county characteristics, mainly farming, over the same period.

Rodefeld enumerated 1592 places and determined their population numbers using the Rand McNally Commercial Atlas and Marketing Guide, the Census of Population, and local informants. The Census enumeration accounted for only 598 of these places, and those were not highly representative of all Michigan places when considering size and direction of population change (see Table 2). Noncensus sources detected the majority of smaller, declining places. The task of generating agricultural and other hinterland information for each place was formidable. Consequently, most of such data was accumulated at the county-level from sources such as Census of Agriculture, Census of Population, etc.

(Table 2 about here)

To date, three studies have utilized the Michigan data. Melcher (1977) investigated the characteristics of Census, noncensus and total enumerated places. Barningham (1977) attempted to explain why some places in metropolitan counties declined in population from 1930 to 1970 (exclusive of annexation). Etua (1977) tested for the relative influence of 14 different factors (including farming and transportation) in the growth and decline of Michigan places. This paper is the first detailed examination in the Project of the role of farming in population change.

We can now elaborate on our choice of the unit of analysis and the operationalizations of the dependent variable used in this paper. With measures of the independent variables at the county level and measures of population change at the place level, there are two possible approaches. First, the analysis could be conducted with variables in their existing forms.

This would be a 'contextual' study with place population change related to the characteristics of counties in which each is located. While this may be a valid approach, it demands special considerations (e.g. ecological fallacy) which are beyond the scope of this paper. Second, the place populations could be aggregated to the county level, in a form that reflects both size and change in such population. The latter approach is taken in this paper, as a compromise between the earlier critique of county level studies and the accessibility of county level data on farming. One operationalization is to aggregate the population numbers for all places 75 to 2500 in size. The mean 'rural' place population across Michigan counties has gradually increased from 5865 in 1930 to 7471 in 1970. Another operationalization is percent of all places in each county decreasing in population. Declining places are more likely to be smaller and unincorporated (see Table 2).

In addition to the substantive question of farming and place population change, we will subject to empirical test our assertion that previous such studies based on statically measured independent variables and on 1960 to 1970 decade analyses have been less than adequate. The statistical analysis will proceed as follows. First, past studies will be replicated by testing the relationships between 1960 farm variables and the 1960-70 change in nonmetropolitan total county population.[7] Second, these relationships will be analyzed for the other operationalizations of the dependent variable--percent change in the population of all places 75-2500 persons and percent of all county places declining in population.[8] Third, these relationships will be analyzed for different time periods--1930 to 1970; 1930 to 1950; 1950 to 1970.[9] Fourth, these relationships will be analyzed for farm variables measured longitudinally as percentage change scores.[10] Last, we will test for additional statistical explanation by introducing two alternative factors--proximity to large places and regional location.[11]

Correlational analysis will be carried out at two levels. First, Pearson product-moment correlation coefficients will be computed to determine the strength and direction of relationships between and within the farm and population variables. Second, multiple correlation coefficients will be computed to determine the relative amount of statistical explanation achieved by each of the manipulations described above. Standardized regression coefficients will be reported in a multiple regression format for the relationships between longitudinally measured farm variables, change in the population of 'rural' places and percent of places declining from 1930 to 1970. Finally, time-lagged partial correlation coefficients will be reported in conjunction with a preliminary discussion of a causal model for relationships between farm and population changes, 1930 to 1970.

The studies reviewed in this paper suggested that changes in farming were important in explaining total population changes in nonmetropolitan counties. We have specified a series of manipulations in conceptualization, operationalization and analysis, in an effort to improve understanding of the relationships between farm and population changes for Michigan places. First, we expect that the farm indendent variables used here will not only improve the proportion of variance expalined in the dependent variable, but that the relationships involved are capable of interpretation and are consistent with existent conceptualizations of farm changes and their consequences.

Second, we expect that the relationships between farming and population change have more explanatory power when county-level, 'place' population variables are employed and the nonmetropolitan county constraint is removed. Third, we expect farm changes from 1930 to 1970 to account for more of the changes in place population, than for a shorter period. In addition, the nature of the relationships, themselves, may change with time. We might

expect the relative importance of farming to have declined from the 1930-50 to the 1950-70 period. Fourth, we expect the relationships between farm and population change to be more manifest when the independent variables are measured longitudinally.

Finally, we want to gauge the overall power of the analysis in comparison with one specific alternative factor (proximity to large places) and with one universal factor (regional location). Our expectation is that these additional factors will not result in substantially greater levels of explained variance above that explained by the farm variables.

We consider this analysis exploratory because it is largely restricted to correlational statistics. However, empirical support for the substantive and methodological hypotheses specified above would provide a measure of support for the approach followed here in explaining the relationship between farm and place population changes. A second phase, which is beyond the scope of this paper, would be to hypothesize and test a causal model for these same change processes. To that end, we will report some partial correlations using a cross-lagged format (see Bohrnstedt, 1969) and discuss a possible causal model.

Results and Discussion

The most typical research design of past studies has been 1960 cross-sectional, independent variables in relation to 1960-70 percentage change scores in total population for nonmetropolitan counties. Zero-order correlation coefficients are reported in Table 3 for the Michigan replication of this design. Two observations are worthy of note. First, the intercorrelations among farm independent variables are generally high, and would seem to indicate these variables are not measuring conceptually distinct processes in farming. Also, further analysis would be problematic because of this

multicollinearity. Frisbie and Poston (1976: 356-359) encountered the same problem and eliminated certain variables where zero-order correlations exceeded 0.50. Next, they factor analyzed the remaining farm variables, and regression analysis with the orthogonal dimensions avoided multicollinearity altogether. However, we choose to persist with the six variables indicated earlier because we believe the change processes they represent are conceptually distinct, and the need is for better measures rather than new or fewer concepts.

(Table 3 about here)

Second, the zero-order correlations between the farm independent variables and change in total population of nonmetropolitan counties are all low. This observation brings into doubt the suggested importance of farming in population change. However, the multiple correlation coefficient (R=0.37) compares favorably to the analysis of Frisbie and Poston (1975: 778, R=0.48) when one considers that the latter included mineral, retail, wholesale, educational, manufacturing and public administration factors as well as farming. The contribution of farming is substantial enough to warrant further exploration.

Multiple correlation coefficients were calculated for relationships between changes in farming and changes in population across the various manipulations, and are shown in Table 4. First, we observe a higher multiple correlation coefficient (R=0.45) for the 1960-70 period when the dependent variable is operationalized as percent change in population of places 75 to 2,500 in size, rather than change in nonmetropolitan county total population. However, the same comparisons for the 1930-70 period (see #2 and 3 in Table 4) do not show an increase in the strength of the relationships; nevertheless,

statistical explanation is significant for both 1960-70 (R^2=0.20) and 1930-70 periods (R^2=0.27 to 0.67) when using 'rural' place population or percent of declining places as dependent variables. This close relationship between farming and population change in smaller places can be readily understood in the context of our review of the literature and extends beyond the arbitrary constraint of nonmetropolitan counties.

(Table 4 about here)

A second observation from Table 4 (#1 and 2) is that lengthening the time period from 1960-70 to 1930-70, raised the multiple correlation coefficients (from R=0.37 and 0.45 to R=0.65 and 0.52 for population change of nonmetropolitan county and 'rural' places, respectively). It is probable that the 10 year period excluded lag effects whereas they were accounted for in the 1930-70 period.

Third, we see that introduction of longitudinally measured (change score) independent variables in place of static variables increased the multiple correlation coefficients further (from R=0.65, 0.52, 0.72 to R=0.81, 0.82, 0.79 for the respective dependent variables). While change scores may not be the most appropriate measures (Bohrstedt, 1969), this sizeable increment in variance explained demonstrates the necessity of dealing with the process of farm change in statistical analysis, and not just the dependence of a county on farming. Thus, our expectations that 'place' population variables, a longer time period and longitudinally measured variables would enhance analytic power, have been empirically confirmed.

The relationships between changes in farming and change in 'rural' place population and percent of places declining, for 1930-70, accounted for 67 and 63 percent of the total variance, respectively. Further details are shown

in Tables 5 and 6. First, we observe from Table 5 that there are some negative or near-zero correlation coefficients between farm variables in their static and change-score forms. For both the value of land and buildings per acre, and farm size in acres, the greater the initial value in 1930, the smaller the percent change from 1930 to 1970. This is apparently a 'ceiling effect' and thus our use of longitudinally measured independent variables is justified.

(Table 5 about here)

Second, the intercorrelations among farm change scores for the 1930-70 period are generally small enough to avoid the problem of multicollinearity. While static measures of farming for 1960 were highly correlated, the smaller associations reported in Table 5 indicate that the farm change processes incorporated into this analysis may be conceptually distinct from one another. One exception is the large and negative zero-order correlation coefficient between value of land and buildings per acre and farm size in acres. This shows that these farm changes have opposite effects on change in place population, and will be further discussed below.

A third observation from Table 5 is that the zero-order correlation coefficients between farm independent variables and county-level 'place' population variables are much greater than for total population change in nonmetropolitan counties over the 1960-70 period. As previously noted, the multiple correlation coefficients were also much greater (R=0.82, 0.79) than for the 1960-70 analysis of Frisbie and Poston (1975; R=0.48) and our replication of that analysis (R=0.37).

The standardized regression coefficients are reported in Table 6. One variable--change in farm population--dominates all others in its positive association (Beta=0.8648) with change in population of places 75 to 2,500 in size.

The greater the decline in farm population for 1930-1970, the greater the decline or smaller the increase in population of these smaller places. Also, change in farm population has a moderate and negative association (Beta= -0.1960) with the percentage of all places in the county that are declining in population. That is, the greater the decline in farm population, the greater the proportion of places declining. That a decline in farm population adversely affects the viability of smaller places is well supported in the literature. However, these results are noteworthy because the relationship holds across all counties in Michigan, which is one of the more industrial states in the U.S.

(Table 6 about here)

Change in farm size is strongly and positively associated (Beta=0.4031) with the percent of places losing population. That is, the greater the increase in farm size for 1930 to 1970, the greater the proportion of declining places. As farms have expanded and become less numerous, both farm workers and farm families have been displaced from farms and the farm population. There is a relatively strong association between changes in farm size and farm population (r= -0.53). However, there is contradictory evidence--the weak but positive association (Beta = 0.1160) between change in farm size and change in 'rural' place population. This would indicate that increased farm size might have caused a greater increase or lesser decline in population of smaller places. Yet the zero order correlation coefficient for this same relationship is negative (r= -0.38). Further investigation is needed.

From Table 6, it is observed that change in the number of farm workers has a moderately strong, negative association (Beta= -0.2802) with percent of places losing population. The greater the decrease in farm workers the greater the proportion of declining places for 1930 to 1970. This relationship

is entirely consistent with the processes of farm size expansion and farm population decline, and the respective zero-order correlations are r= -0.39 and r=0.25. Again, the weaker relationship between farm work force and 'rural' place population change is in the opposite direction (Beta= -0.1453). Like the analogous situation for changing farm size, this anomaly warrants further exploration.

The only other farm variable that has an appreciable effect on population change is value of land and buildings per acre. The magnitudes of the regression coefficients are not large, but the directions are consistent. The greater the increase in acre capital value, the greater the increase or lesser the decline in 'rural' place population (Beta=0.1835), and the smaller the proportion of county places declining in population, 1930 to 1970 (Beta= -0.1051). And, this is consistent with the strong, negative correlation between acre capital value and farm size (r= -0.70). Why should more capital intensive farming enhance viability of smaller places? Possible explanations are: (1) that land intensive development has occurred to some extent in farming, and when other factors are controlled, it has not displaced labor and farm people, and in turn has not eroded the population base of farm trade centers; or (2) that expansion at the metropolitan fringe is a common cause of appreciation in land values and growth in smaller places.

In summary, these results have lent support to our suggested changes in conceptualization of farm changes, operationalization of population changes, and procedures of statistical analysis. In addition we have seen that farming has been a very important factor in the changing population of all smaller places in Michigan, from 1930 to 1970.

One final manipulation was to divide the 1930-70 time period into two, and observe if the nature of the relationships between farm independent

variables and 'place' population change have changed with time. The multiple correlation coefficients reported in Table 4 (#4 and 5) would suggest not. While the strength of the association declined (R=0.50 to 0.43) for 'rural' place population, it increased (R=0.64 to 0.79) for percent places declining in population. The general importance of farming does not appear to have declined in its determination of smaller place population in Michigan, at least since 1930.

We know that transportation, industry and other factors are important correlates of population change in Michigan places (Etua, 1977) and that regional location is highly correlated with the three operationalizations of the dependent variable in our analysis (r=0.46, 0.32, -0.79). We also know that the proximity of smaller places to large popolation centers influences their rate of population growth or decline, and the zero-order correlations from this analysis confirm this (r=0.31, 0.12 -0.56). In Table 7 we see that region and proximity accounted for 12 percent of the variance in 'rural' place population and 63 percent of the variance in percent places declining. In the latter case, 56 percent of the variance was shared by farm variables and these alternative factors.

(Table 7 about here)

Region and proximity were introduced into the regression analysis for 1930-70, and the results are shown in Table 8. For the regression on 'rural' place population change there was little change in standardized slopes for the farm variables, and proximity to large places exhibited a moderately strong, negative association (Beta= -0.2402). That is, the more distant counties were from those with places of 50,000 persons or more, the greater the increase or lesser the decline in population of places 75 to 2,500 in size.

Alternatively, regional location was the dominant alternative factor (Beta= -0.3602) in regression on percent places declining, and it did weaken the regression coefficients for farm variables. The less industrial and urban the region the greater the percent of declining places in the county.

(Table 8 about here)

Further investigation is necessary in both cases. Although proximity did not appear to be a dominant factor, the direction of its relationship with 'rural' place population is the opposite to most findings. Before we can attribute significance to this result as a substantive finding, further work is needed on the way proximity was operationalized as a variable. Etua (1977: 148-155) found that population size of Michigan smaller places was positively related to distance from a larger place of less than 10,000 persons in size, but negatively related to distance from a larger place with greater than 10,000 inhabitants. The opposing forces of competition and symbiosis between smaller and larger places (Etua, 1977:76) need to be isolated in further operationalization of the proximity variable. Although farm changes do account for most of the regional differences, the relative importance of region in its regression on percent of declining places does raise the question of which is the 'real' explanation of population change--farming or region. It will be necessary to explore the concept of metropolitan dominance further.

A Hypothetical Causal Model

While longitudinal measures on the independent variables are necessary for adequate understanding, the use of change scores is not generally recommended. The main problem with change scores is that they are biased by the initial value on that variable (Borhnstedt, 1969:115). For example,

one would expect the magnitude of percent changes to be larger for small place populations precisely because the initial figure is small. Bohrnstedt (1969) has suggested the use of partial correlation or regression coefficients which measure the relationship between the initial value of the independent variable (e.g. farm population in 1930) and the final value of the dependent variable (e.g. place population in 1970) while fully controlling for the initial value on the dependent variable (e.g. place population in 1930). And, if this causality (e.g. farm population→ place population) is to be confirmed empirically, then its partial correlation or regression coefficient must be greater than the reverse relationship (e.g. 1930 place population predicting to 1970 farm population, controlling for 1930 farm population).

Bohrnstedt's modified cross-lagged approach was applied to all possible combinations of the six farm independent variables and population of places 75 to 2,500 in size. Figure 1 shows only those partial correlation coefficients that were significant at the 0.05 level and the appropriate direction of causation. In some cases both directions have significant coefficient and the lesser 'path' is identified. We can conclude that 'rural' place population is the dependent variable in a causal sense and that farm population may be an intervening variable between other farm variables and population change. It also seems obvious that some of the anomalies found in the regression analysis may have been artifacts of change scores. For example, the number of farm workers is strongly and positively associated with rural place population whereas the regression slope was weaker and negative. Adoption of such a cross-lagged technique in place of change scores is imperative.

(Figure 1 about here)

Conclusion

The objective of this paper was to explore the relationships between changes in farming and changes in place population for Michigan from 1930 to 1970. Following a critical review of past studies we selected six variables as indicators of the changing structure of farming. We also replaced the commonly used dependent variable of change in the total population of nonmetropolitan counties with two variables measuring the population change of smaller places in all counties. Finally, the time period was extended to 1930-70 and longitudinally measured independent variables were used. The statistical results confirmed that our conceptual, operational and statistical modifications did increase the explanatory power of the analysis. Farming is still an important factor in the population change of smaller places and these modifications suggest that farm changes have played a more important role than indicated in earlier analyses using different measures and units.

Further extensions of this exploratory analysis are suggested. First, two of the farm variables--acres of land in crops and average farm sales--contributed little to change in place population and perhaps could be omitted from further analyses. In their place we might consider inclusion of variables for other farm change processes, particularly absentee ownership of farm land, proportion of full-time hired laborers, and incidence of part-time farming. All three appear to have been important components of farm changes in recent decades (Goss et al., 1978). Second, two operationalizations of the dependent variable were focussed on the changing population status of smaller places and were at the county level. Further variations should be attempted to include larger places particularly those up to 50,000 in size. Also, a 'contextual' analysis, where population size of individual places is the dependent variable, should be attempted.

Third, some of the relationships were unstable across the correlation and regression analyses and after including regional location as a variable. We suspect this was partly due to the biases of change scores and to one or two instances of multicollinearity. Further analysis is suggested using the cross-lagged analytic design. However, metropolitan dominance may be operating as a 'third factor' to reverse the traditional relationships between farming and place population for those places within commuting distance of large cities. This does not justify restricting analyses to nonmetropolitan counties, but suggests the introduction of a metropolitan status variable and greater specificity in the variable of proximity to larger places.

Finally, it appears that farm change processes can be conceptualized according to a causal sequence, with farm population as the major intervening variable between farming and place population. Confirmation of such a model would increase the explanatory power of the analysis, and path analysis is suggested as a suitable technique. The preceding issues will be addressed in the near future as part of the first author's doctoral dissertation.

Footnotes

[3]This review of the vast literature on changing structure of U.S. farming will be necessarily brief. We have written more comprehensive reviews elsewhere (see Rodefeld, 1974: 39-210; Rodefeld, 1978; and Goss et al., 1978).

[4]We have also written more comprehensive reviews of the literature on the consequences of farm changes of rural areas and society in general (Goss, 1976: 77-163; Rodefeld, 1974) together with our colleague Joseph Etua (1977: 1-84).

[5]These are the 'places enumerated in Michigan for this research. By convention, hamlets are places with population less than 250, villages are places with population 250 to 2,500, and towns or cities are places with population 2,500 and over (Ensminger and Longmore, 1949:79).

[6]An assessment of the relative influence of transportation, farming, industry and other factors for Michigan places has been done by Etua (1977).

[7]Measures for four of the independent variables--acres in crop land as a percentage of all county land, value of land and buildings per acre, average farm size in acres, gross sales per farm--were taken from the 1959 Census of Agriculture. Measures for number of workers employed in farming as a percentage of all workers, and number of farm people were taken from the 1960 Census of Population. County population figures came from the 1960 and 1970 Censuses of Population.

[8]Both operationalizations of the dependent variable were calculated from the Michigan project data.

[9]Measures for four farm variables were taken from the 1930, 1950, and 1969 Censuses of Agriculture. All other measures came from either the Censuses of Population or the Michigan project data, and were for 1930, 1950, and 1970.

[10]When calculating change scores for value of land and building per acre and gross sales per farm, the second measure (i.e. 1969/70, 1950) was revalued to be equivalent to the first measure (1930, 1950) to control for inflation. The Consumer Price Index was used as the deflator.

[11]Proximity to large places was operationalized as a discrete variable: 1 = a county which has no place greater than 50,000 and is not adjacent to a county with any place greater than 50,000; 2 = a county with no place greater than 50,000 but adjacent to a county with a place greater than 50,000; and 3 = a county with a place greater than 50,000. Regional location consisted of six categories: Upper penisula--west = ; Upper penisula--east = 2; Lower peninsula--northwest = 3; Lower peninsula--northeast = 4; Lower peninsula--southwest = 5; and Lower peninsula--southeast = 6.

Bibliography

Ball, A. Gordon and Earl O. Heady
1972 "Trends in farm and enterprise size and scale." Pp. 40-58 in A. Gordon Ball and Earl O. Heady (eds.). Size, Structure and Future of Farms. Ames: Iowa State University Press.

Barningham, Douglas A.
1977 "Deviant case analysis of declining places in Michigan metropolitan counties." Plan B Technical Research Paper, Department of Resource Development, Michigan State University, East Lansing.

Beale, Calvin L.
1975 The Revival of Population Growth in Nonmetropolitan America. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service, ERS-605.

Beale, Calvin L.
1976 "A further look at nonmetropolitan population growth since 1970." American Journal of Agricultural Economics 58(5): 953-958.

Beale, Calvin L.
1977 "Current status of the shift of U.S. population to smaller communities." Unpublished paper presented at meetings of the Population Association of America, St. Louis, Missouri, April 1977.

Beale, Calvin L. and Glenn V. Fuguitt
1976 The New Pattern of Nonmetropolitan Population Change. Madison: University of Wisconsin, Center for Demography and Ecology, CDE working paper 75-22 revised.

Bohrnstedt, George W.
1969 "Observations on the measurement of change." Pp. 113-133, in Edgar F. Borgatta (ed.), Sociological Methodology 1969. San Francisco: Jossey-Bass.

Bollinger, W. LaMar
1972 "The economic and social impact of the depopulation process upon four selected counties in Idaho." Pp. 561-598 in Sara Mills Mazie (ed.) Population Distribution and Policy. Washington, D.C.: The President's Commission on Population Growth and the American Future, Volume V.

Brake, John R.
1972 "Capital and credit." Pp. 123-143 in A. Gordon Ball and Earl. O. Heady (eds.) Size, Structure and Future of Farms. Ames: Iowa State University Press.

Brunn, Stanley, David
1968 "Changes in the service structure of rural trade centers." Rural Sociology 33(2):200-206.

Butler, James E. and Glenn V. Fuguitt
1970 "Small-town population change and distance from larger towns: A replication of Hassinger's study." Rural Sociology 35(3):396-409.

Debertin, D. L. and G. L. Bradford
1976 "Conceptualizing and quantifying factors influencing growth and development of rural economies." Annals of Regional Science 10(1):29-40.

Donaldson, G. F. and J. P. McInerney
1973 "Changing machinery technology and agricultural adjustment." American Journal of Agricultural Economics 55(5):829-839.

Ensminger, Douglas
1949 "Rural neighborhoods and communities." Pp. 55-77 in Carl C. Taylor et al. (eds.) Rural Life in the United States. New York: Alfred A. Knopf.

Ensminger, Douglas and T. Wilson Longmore
1949 "Rural trade areas and villages." Pp. 78-91 in Carl C. Taylor et al. (eds.)Rural Life in the United States. New York: Alfred A. Knopf.

Etua, Joseph A.
1977 "Factors associated with growth and decline of places in Michigan 1930-1970." Unpublished Ph.D. dissertation, Department of Resource Development, Michigan State University, East Lansing.

Field, Donald R. and Robert M. Dimit
1970 Population Change in South Dakota Small Towns and Cities, 1949-1960. Brookings: South Dakota Agricultural Experiment Station, Bulletin 571.

Forscht, R. Gar and J. Dean Jansma
1975 Economic and Population Growth in Smaller Central Place Areas of Pennsylvania. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service, Agricultural Economic REport 310.

Frisbie, W. Parker and Dudley L. Poston
1975 "Components of sustenance organization and nonmetropolitan population change: A human ecological investigation." American Sociological Review 40(Dec.):773-784.

Frisbie, W. Parker and Dudley L. Poston
1976 "The structure of sustenance organization and population change in nonmetropolitan America." Rural Sociology 41(3):354-370.

Frundt, Henry John
1975 "American agribusiness and U.S. foreign agricultural policy." Unpublished Ph.D. dissertation, Department of Sociology, Rutgers University, New Brunswick, N.J.

Fuguitt, Glenn V.
1971 "The places left behind: Population trends and policy for rural America." Rural Sociology 36(4):449-470.

Fuguitt, Glenn V. and Nora A. Deeley
1966 "Retail service patterns and small town population change: A replication of Hassinger's study." Rural Sociology 31(1):53-63.

Galpin, Charles J.
1915 The Social Anatomy of an Agricultural Community. Madison: University of Wisconsin, Agricultrual Experiment Station, Research Bulletin 34.

Goss, Kevin F.
1976 Consequences of diffusion of innovations: The case of mechanization in U.S. agriculture." Unpublished M.A. thesis, Department of Communication, Michigan State University, East Lansing.

Goss Kevin F., Frederick H. Buttel and Richard D. Rodefeld
1978 "The political economy of class structure in U.S. agriculture: A theoretical outline." in Frederick H. Buttel, Howard Newby and Ada Cavazzani (eds.), Critical Perspectives in Rural Sociology. Montclair, N.J.: Allanheld, Osmun and Co., forthcoming.

Hacker, Louis, M.
1970 The Course of American Economic Growth and Development. New York: John Wiley and Sons.

Hassinger, Edward
1957a "The relationship of trade center population change to distance from larger centers in an agricultural area." Rural Sociology 22(2):131-136.

Hassinger, Edward
1957b "The relationship of retail-service patterns to trade-center population change." Rural Sociology 22(3):235-240.

Kolb, John H.
1959 Emerging Rural Communities: Group Relations in Rural Society: A Review of Wisconsin Research in Action. Madison: University of Wisconsin Press.

Luloff,A. E. and Kenneth P. Wilkinson
1978 "Local Perception of Problem-solving Auspices." Storrs, Conn." Northeast Regional Research Project, Working paper 13.

McDonald, Stephen L.
1955-56 "Farm outmigration as an integrative adjustment to economic growth." Social Forces 34:119-128.

Melcher, John E.
1977 "Census underenumeration of Michigan population centers." Plan B Technical Research Paper, Department of Resource Development, Michigan State University, East Lansing.

Padfield, Harland I.
1971 "Agrarian capitalists and urban proletariat: The policy of alienation in American agriculture." In W. G. McGinnies et al. (eds.) Food, Fiber and the Arid Lands. Tucson: University of Arizona Press.

Raup, Philip M.
1961 "Economic aspects of population decline in rural communities." Ch. 9 in Labor Mobility and Population in Agriculture (Center for Agricultural and Economic Adjustment). Ames: Iowa State University Press.

Rodefeld, Richard D.
1974 "The changing organizational and occupational structure of farming and the implications for farm work force individuals, families and communities." Unpublished Ph.D. dissertation, Department of Sociology, University of Wisconsin, Madison.

Rodefeld, Richard D.
1976 "Enumerating Michigan population centers (places) and determining their size from 1930 to 1970: Rationale, procedures, problems and results." East Lansing: Michigan State University, Agricultural Experiment Station, forthcoming research report.

Rodefeld, Richard D.
1978 "Trends in U.S. farm organizational structure and type." In Richard D. Rodefeld et al. (eds.), Change in Rural America: Causes, Consequences and Alternatives. St. Louis, Missouri: C. V. Mosby.

Tolley, G. S. and B. M. Farmer
1967 "Farm labor adjustments to changing technology." Pp. 41-52 in C. E. Bishop (ed.) Farm Labor in the United States. New York: Columbia University Press.

U.S. Bureau of the Census
1975 Historical Statistics of the United States. Washington D.C.: U.S. Government Printing Office, Part 1.

White, T. Kelley and Geroge D. Irwin
1972 "Farm size and specialization," Pp. 190-213 in A. Gordon Ball and Earl O. Heady (eds.) Size, Structure and Future of Farms. Ames: Iowa State University Press.

Wilkinson, Kenneth P.
1974 "Consequences of decline and social adjustment to it." Pp. 43-53 in Larry R. Whiting (ed.), Communities Left Behind: Alternatives for Development. Ames: Iowa State University Press.

Table 1. Selected Characteristics of Farming, United States, 1935-70.

Date	Farm Land in Crop (Million Acres)	Value of Land and Buildings Per Acre (Current Dollars)	Average Farm Size (Acres)	Gross Sales Per Farm (1958 Dollars)	Number of Farm Workers (Million)	Farm Population (Million)
1935	513.9	31.16	155	3,305	12.73	32.16
1940	530.6	31.69	175	4,295	10.98	30.55
1945	450.7	40.63	195	5,085	10.00	24.42
1950	478.3	64.97	216	6,030	9.93	23.05
1954/55	459.6	85.32	258	7,675	8.38	19.08
1959/60	448.1	116.49	297	9,900	7.06	15.64
1964/65	434.2	146.18	340	12,885	5.61	12.36
1969/70	459.0	193.23	373	16,100	4.52	9.71
Percent change 1935-70	-10.7	+83.9	+140.6	+387.1	-64.5	-69.8

Source: U.S. Bureau of the Census, 1975, pp. 457, 467-468, 480-481.

Table 2. The Number of Places Exceeding 74 and the Percent Declining in Population, According to Source of Enumeration, Michigan, 1930-1970.[a]

1930 Size of Place	Census		Other Sources		Total	
	Number of Places	Percent Declining	Number of Places	Percent Declining	Number of Places	Percent Declining
0- 74	21	0.0	250	14.4	271	13.3
75- 149	15	6.7	267	50.6	282	48.2
150- 299	72	9.7	254	53.9	326	44.2
300- 499	106	4.7	96	58.3	202	30.2
500- 749	72	11.1	26	88.5	98	31.6
750- 999	49	4.1	9	88.9	58	17.2
1000-2499	124	7.3	16	81.2	140	15.7
2500+	121	17.4	5	20.0	126	17.5
Total	580	9.0	923	44.3	1503	30.7

[a]Missing data: Census=16, Other Sources=61.
No change: Census=2, Other Sources=10.

Source: Rodefeld, 1976, "selected tables," Table 21.

Table 3. Correlation Matrix for Independent, and Dependent Variables, Michigan Nonmetropolitan Counties, 1960-70.

	Independent Variables (1960)					
	Crop Area	Acre Capital Value	Farm Size	Farm Sales	Farm Workers	Farm Population
Independent variables (1960)						
Crop area	1.00					
Acre capital value	.84	1.00				
Farm size	-.57	-.68	1.00			
Farm sales	.81	.81	-.40	1.00		
Farm workers	.45	.22	-.13	.42	1.00	
Farm population	.93	.86	-.63	.78	.39	1.00
Dependent variable (1960-70 change score)						
County population	.09	.08	.07	.07	.06	.03

Multiple correlation coefficient = .37

Coefficient of determination = .14

Table 4. Multiple Correlation Coefficients for Various Manipulations of Variables, Michigan, 1930-50-60-70.

Manipulations	Dependent Variables: County Population (Nonmetropolitan Counties)	Dependent Variables: "Rural" Place Population (All Counties)	Dependent Variables: Percent Places Declining (All Counties)
1. 1960 independent variables 1960-70 dependent variables	.37	.45	
2. 1930 independent variables 1930-70 dependent variables	.65	.52	.72
3. 1930-70 independent variables 1930-70 dependent variables	.81	.82	.79
4. 1930-50 independent variables 1930-50 dependent variables		.51	.64
5. 1950-70 independent variables 1950-70 dependent variables		.43	.79
6. Proximity to large places (1930-70)		.12	-.56
Regional location (1930-70)		.32	-.79
Proximity and region (1930-70)		.35	.79

Table 5. Correlation Matrices for Independent, and Dependent Variables, Michigan Counties, 1930-70.

	Independent Variables (1930-70 Change Scores)					
	Crop Area	Acre Capital Value	Farm Size	Farm Sales	Farm Workers	Farm Population
Independent variables (1930 static)						
Crop area	.42	.25	-.52	.01	.62	.24
Acre capital value	-.20	-.20	-.19	-.06	.44	.07
Farm size	.21	.48	-.33	-.13	-.10	.34
Farm sales	.26	.33	-.51	-.06	.68	.25
Farm workers	.36	.44	-.32	.04	.09	-.02
Farm population	.33	.07	-.35	.08	.59	.18
Independent variables (1930-70 change scores)						
Crop area	1.00					
Acre capital value	.18	1.00				
Farm size	-.18	-.70	1.00			
Farm sales	.15	.02	.16	1.00		
Farm workers	.35	.12	-.39	.25	1.00	
Farm population	.17	.32	-.53	-.24	.25	1.00
Dependent variables (1930-70 change scores)						
"Rural" place population	.10	.34	-.38	-.15	.16	.72
Percent places declining	-.31	-.50	.71	.01	-.58	-.52

Table 6. Standardized Regression Coefficients Between Farm Independent Variables and Population Change, Michigan Counties, 1930-70.

Dependent Variables					
	"Rural" Place Population			Percent Places Declining	
Independent Variables (1930-70)	Beta	Standard Error	Independent Variables (1930-70)	Beta	Standard Error
Farm population	.8646***	.2841	Farm size	.4031**	.0584
Acre capital value	.1835	.1254	Farm workers	-.2802**	.3321
Farm workers	-.1453	1.0672	Farm population	-.1960*	.0884
Farm size	.1160	.1877	Acre capital value	-.1051	.0390
Farm sales	.0760	.0896	Crop area	-.0838	.0817
Crop area	-.0339	.2625	Farm sales	-.0226	.0279
	R = .82			R = .79	
	R^2 = .67			R^2 = .63	

[a]Asterisks denote the level of significance of the standardized regression coefficients; *** = $p < 0.001$, ** = $p < 0.01$, and * = $p < 0.05$.

Table 7. Coefficients of Determination for Independent Variables and Alternative Factors, Michigan Counties, 1930–70.

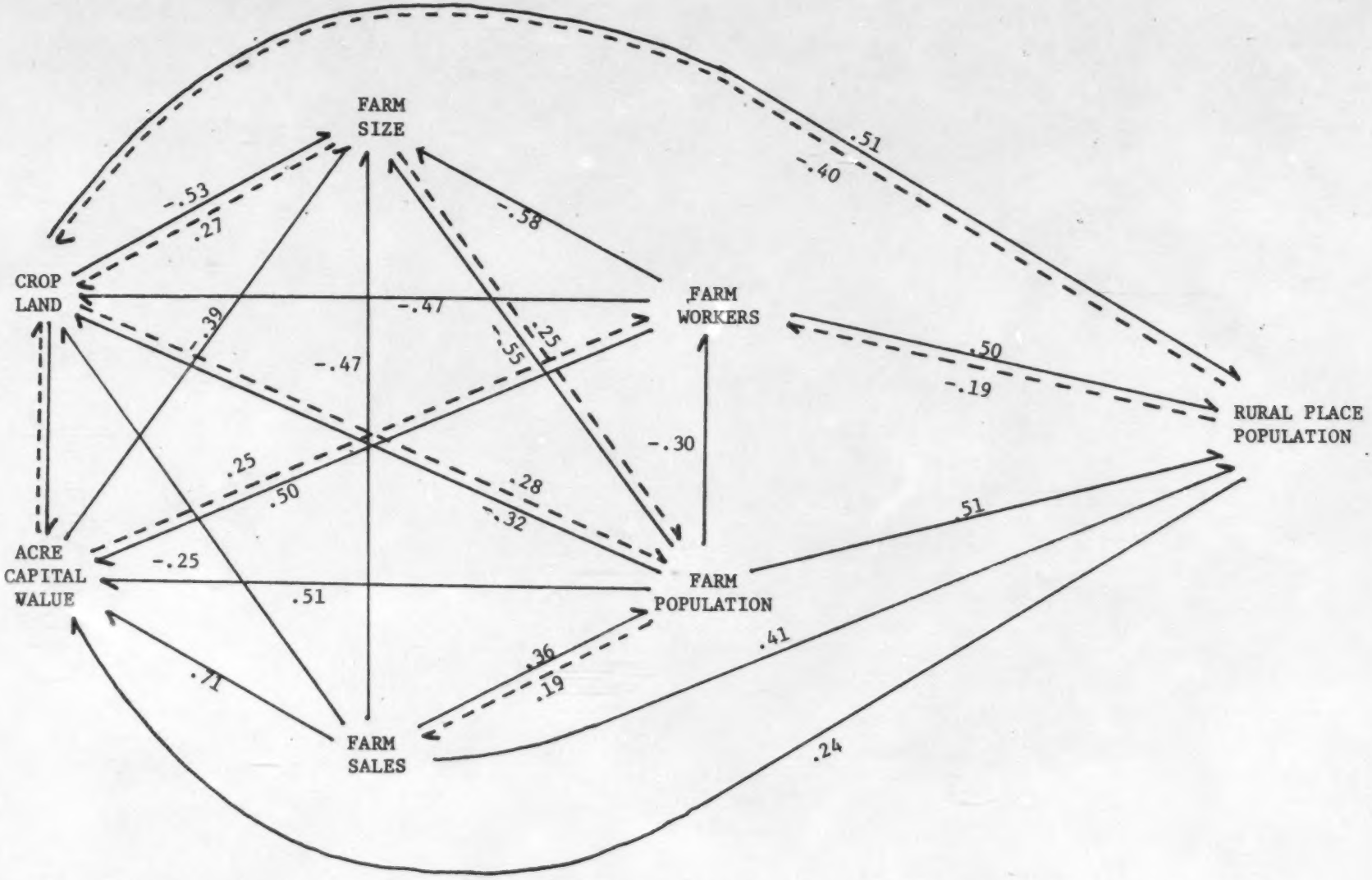
	Dependent Variables	
	"Rural" Place Population	Percent Places Declining
Independent variables		
Total contribution	.67	.63
Control variables		
Shared contribution	.09	.56
Unique contribution	.03	.07
Total contribution	.12	.63
All variables		
Total contribution	.70	.70

Table 8. Standardized Regression Coefficients Between Farm Variables, Alternative Factors and Population Change, Michigan Counties, 1930-70.

Dependent Variables					
	"Rural" Place Population			Percent Places Declining	
Independent, Alternative Variables (1930-70)	Beta	Standard Error	Independent, Alternative Variables (1930-70)	Beta	Standard Error
Farm population	.8909***[a]	.2797	Region	-.3602*	2.024
Proximity	-.2402*	12.06	Farm size	.2191	.0589
Acre capital value	.1500	.1239	Farm population	-.1592	.0816
Region	.1387	6.934	Farm workers	-.1148	.3350
Farm size	.1366	.2017	Proximity	-.1026	3.509
Farm workers	-.0798	1.148	Acre capital value	-.0936	.0362
Crop area	-.0795	.2822	Farm sales	-.0706	.0258
Farm sales	.0659	.0883	Crop area	-.0221	.0823
$R = .84$			$R = .84$		
$R^2 = .70$			$R^2 = .70$		

[a]Asterisks denote the level of significance of the standardized regression coefficients; *** = $p < 0.001$, ** = $p < 0.01$, and * = $p < 0.05$.

Figure 1. Cross-Lagged Partial Correlation Coefficients for Farm Independent Variables and "Rural" Population, Michigan, 1930-70.[a]



*Only those partial correlation coefficients with $p < 0.05$ (N=78-80) are reported; and where both "paths" are significant the lesser one is indicated thus (-->).